Planetary Science Division Update

Presentation at the
Outer Planet Assessment Group

James L. Green
Director, Planetary Science Division

May 1, 2007

Administrative Changes

- Key Civil Servant positions have been filled:
  - James L. Green, Director
  - James Adams, Deputy Director

- Civil servant positions to be filled
  - Discovery Program Executive - Filled (Lindley Johnson)
  - A Discovery Program Scientist (ad will be posted)

- Other staff changes and positions filled:
  - Alan Harmon, Detailed from DOE new Program Executive for Radio-isotope Power Systems
  - Kelly Snook, Lunar Science Liaison with ESMD
  - Tom Morgan detailed to GSFC as Senior Scientist for Lunar Exploration

Outline

- Division overview
  - Administrative changes
  - FY07 and FY08 Budgets
  - Upcoming conferences

- Mission Status
  - Discovery and Scout Selections
  - Cassini Senior Review

- R&A Program
  - NEO program status
  - New PSD Selection Policy
  - FY07 R&A enhancements

- Technology Program

Division Activities

- Current National Academy reviews of Planetary Science Division:
  - Based on the NASA Authorization 2005
    - Planetary Performance Assessment Committee formed (meetings: Feb. 22-24, March 26-28, 2007 ....)
    - How well is PSD addressing the strategies, goals, and priorities outlined in Academy reports
  - COMPLEX - providing guidelines for the selection of candidate missions for the next New Frontiers AO
  - Evaluate NAI's success leading to reshaping the future of astrobiology activity
FY07 Budget Implications

What Stayed the Same:
- Discovery 2006 and Mars Scout AO’s on track
  - Selected 3 Discovery full-class and 3 Mission of Opportunity (MoO) mission concept studies
  - Selected 2 Mars Scout full-class and 1 MoO and 2 MoOs for technology development
- Phoenix scheduled for launch in August 2007 and MSL in 2009
- New Frontiers AO #3 no later than 2008
- Moon Mineralogy Mapper (M3), selected as a Discovery MoO, on schedule to launch on the ISRO Chandrayaan-1 spacecraft
- Continues operations of Mars Rovers (Spirit, Opportunity), Odyssey, Mars Express, Mars Reconnaissance Orbiter (MRO), MESSENGER, ASPERA-3, New Horizons, Cassini, and Rosetta

FY07 Budget Implications (cont.)

What’s Changed:
- Funds Dawn for a launch in June 2007
- Funds Juno for a launch in August 2011
- Confirms and provides additional funding for Mars Science Laboratory (MSL) to reduce schedule risk for 2009 launch
- Adds a new Lunar Science Research project to enhance opportunity for lunar scientific discovery
- Funds Outer Planets mission concept studies
- Planetary Research and Analysis (R&A) changes:
  - Provides partial restoration (~$5 RM) of the 15% cut
  - Transfers Deep Space Network to the Space Operations Missions Directorate (SOMD) but kept the navigation tools & systems
  - Transfers Near Earth Objects (NEO) to Exploration Systems Mission Directorate (ESMD)

Planetary Science Division

FY08 Budget, Total $1320M (included "Simplified" Full Cost)

Ices, Oceans, and Fire:
Satellites of the Outer Solar System

- Purpose is to bring together researchers to share their work in the broader context of common processes and unique properties shaping the satellites of the outer solar system
- The goal of the conference is to promote cross fertilization of research among small communities focused on specific satellites
- Papers in special issue of JGR-Planets
- August 13-15 in Boulder, CO

http://www.lpi.usra.edu/meetings/icysat2007/home.shtml
Discovery at 15: Looking Backward Looking Forward

- Open to the scientific community
- All former Discovery Principal Investigators, Project Managers, and Education/Public Outreach Leads
- Session include:
  - Invited talks
  - Contributed posters on mission concepts and new technologies
- September 19-20, 2007 in Huntsville, AL

Flight Mission Status

Current Mission Status

- Mars: MRO, MER-1, MER-2, Mars Odyssey
  - Upcoming Launch: MSL and Phoenix
- Discovery: MESSENGER, Deep Impact, Stardust
  - Upcoming Launch: Dawn
- Lunar Science Research Project
  - Upcoming Launch & Extended Mission: LRO
- New Frontiers: New Horizons
  - Upcoming Launch: Juno
- Flagships: Cassini/Huygens at Saturn
  - Upcoming Launch: Mars Science Laboratory (MSL)
- International: Mars Express, Venus Express, Rosetta, Hayabusa, and ExoMars
  - Upcoming Launch: Moon Mineralogy Mapper - Chandrayan

Planetary Mission Future Events

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<tbody>
<tr>
<td>Feb 28, NH @ Jupiter</td>
<td>Jan 14 MESSENER @ Mercury</td>
<td>April Dawn @ Mars</td>
<td>LRO Science Mission</td>
<td>March 3 MESSENER @ Mercury</td>
<td>Discovery</td>
<td>New Frontiers 3</td>
<td>Discovery</td>
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<td>June 5, MESSENER @ Venus</td>
<td>Oct 6 MESSENER @ Mercury</td>
<td>Sept 29 MESSENER @ Mercury</td>
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<td>Dawn</td>
<td>LRO-LCROSS</td>
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<td>Phoenix</td>
<td>Phoenix Lander</td>
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- Planetary Division launches (green)
- Planetary mission events (red)
- Exploration Systems Mission Directorate (blue)
Selected Phase-A Full Missions

- **GRAIL**: Gravity Recovery and Interior Laboratory - Maria Zuber (PI), MIT — Produce a uniform, global, high-quality gravity field mapping of the Moon that will allow for unprecedented modeling of its internal structure and thermal history.

- **OSIRIS**: Origins Spectral Interpretation, Resource Identification, and Security - Michael Drake (PI), University of Arizona — Survey asteroid 1999 RQ36 and provide return of uncontaminated surface sample to Earth.

- **Vesper**: Venus Chemistry and Dynamics Orbiter - Gordon Chin (PI), NASA GFSC — Advance our understanding of the atmospheric composition and dynamics of Venus, especially its photochemistry.

Mission of Opportunity

- **DIXI**: Deep Impact eXtended Investigation of Comets - Michael A'Hearn (PI), University of Maryland — Uses the existing Deep Impact spacecraft for an extended flyby mission to a second comet, Boethin, that will return data advancing our understanding of the nature of comet nuclei.

- **EPOCH**: Extrasolar Planet Observations and Characterization - L. Drake Deming (PI), NASA GSFC — Observations using Deep Impact's High Resolution Imager will either lead to the discovery of additional low mass (down to one Earth-mass) planets or will set limits on the existence of such planets that will be useful for constraining theories of planet formation.

- **Stardust NEXT**: A Mission of Opportunity to complete the exploration of Tempel 1 - Joseph Veverka (PI), Cornell University — Uses the Stardust spacecraft to perform an extended flyby mission to comet Tempel 1 which will provide the first look at the changes to a comet nucleus after a perihelion passage.

- Proposals submitted March 20th

Mars Scout Selections

- Selections announced January 8, 2007
  - Phase-A studies for 9 months with $2 M

- **MAVEN**: Mars Atmosphere and Volatile Evolution - Bruce Jakosky (Univ. of Colorado) - Mars climate and habitability and improve understanding of dynamic processes in the upper atmosphere and ionosphere.

- **TGE - The Great Escape**: Jim Burch (SWRI) - Determine basic processes in Martian atmospheric evolution by measuring the structure and dynamics of the upper atmosphere.

- Mission of Opportunities include:
  - Mars Organic and Oxidant Detector - J. Bada (UC at San Diego)
  - Mars Organic Molecule Analyzer - L. Becker (UC Santa Barbara)
  - Co-I for Raman-LIBS instrument on ExoMars

Cassini Senior Review

- Senior Review (Science) held February 15, 2007
    - Cassini spacecraft virtually 100% operational
  - Proposed extended mission goes to July 2010
  - Extended mission science goals include:
    - Titan (26 encounters)
    - Enceladus (7 encounters + Rhea, Dione)
    - Observe Saturn System thru Aug. '09 equinox
  - Panel recommendations and findings were delivered to NASA Headquarters March 9, 2007
  - PSD thanks the panel chair, Melissa McGrath and science panel members:
    - Jay Bergstralh, David Black, John Casani, William Hubbard, Chris McKay, Richard Horne, Faith Vilas
  - Next Steps:
    - Conduct an operations review (July)
      - Lessons learned from the MGS mishap investigation
  - PSD has budgeted for a mission extension
PSD R&A Program

ROSES 2007 Released on February 16, 2007

New PSD R&A Policy

- Issued February 20, 2007 - effective immediately
  - Applies to all PSD R&A elements in ROSES
- Rapid notification and funding procedure
  - Within four weeks of the review panel I expect to sign an "initial Selection Decision Document" or SDD - within 2 weeks goal!
  - Proposals are in "Selected, Selectable, Not Selected" categories
    - Selectable proposals are those in competitive range that may have a chance to be selected pending identification of funds
  - Letters issued to all with Selected proposals funded
  - As funding becomes available/identified a new addendum is added to the SDD and signed then those proposals in the Selectable range are funded
  - With final budget authority, letters sent to the selectable but deferred category are notified of their non-selection

NEO Program Transition

- Objective: Discover 90% of NEOs > 1 km in size within 10 years (1998 – 2008)
  - Expected to achieve goal
  - See: http.neo.jpl.nasa.gov/stats
- Program transitioned to ESMD Oct 1, 2007
  - Budget of $4.1M R&A funds moved to ESMD account
- Transition done smoothly with minor hiccups
  - Different WBS and funding channels to initiate
    - Should be transparent to survey teams, with minor delays
  - New agreement on solicitation for NEO in 2007
    - Will be done as forthcoming amendment to ROSES-07
  - FY08 we SMD will have the NEOO program back!

PSD R&A Program for ROSES 2006

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<th>ROSES 2006 Program Element</th>
<th>Due</th>
<th>Selection Date</th>
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<td>C.09 Cassini Data Analysis</td>
<td>4/25/06</td>
<td>12/15/06</td>
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<td>C.00 Outer Planets Research</td>
<td>4/20/06</td>
<td>1/31/07</td>
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<tr>
<td>C.10 Discovery Data Analysis</td>
<td>4/28/06</td>
<td>11/22/06</td>
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<td>C.04 Planetary Geology and Geophysics</td>
<td>5/6/06</td>
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<td>C.02 Cosmochemistry</td>
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<td>C.12 Mars Fundamental Research</td>
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<td>This Week</td>
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<td>C.05 Planetary Astronomy</td>
<td>6/2/06</td>
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<td>E.03 Origins of Solar Systems</td>
<td>6/2/06</td>
<td>1/17/07</td>
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<td>C.06 Near Earth Object Observations</td>
<td>6/8/06</td>
<td>4/13/07</td>
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<td>C.07 Planetary Atmospheres</td>
<td>6/18/06</td>
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<td>C.03 Sample Return Laboratory Instruments and Data Analysis</td>
<td>6/30/06</td>
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<td>C.15 Mars Reconnaissance Orbiter Participating Scientists</td>
<td>6/30/06</td>
<td>12/1/06</td>
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<td>C.10 MECCOR Mission Participating Scientists</td>
<td>7/7/06</td>
<td>3/07/07</td>
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<td>C.19 Planetary Protection Research</td>
<td>8/4/06</td>
<td>2/20/07</td>
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<td>C.11 Mars Data Analysis</td>
<td>8/11/06</td>
<td>Early May</td>
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<tr>
<td>C.17 Planetary Instrument Definition and Development</td>
<td>8/18/06</td>
<td>4/6/07</td>
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<td>C.25 Stardust Sample Analysis</td>
<td>1/19/07</td>
<td>4/23/07</td>
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<td>C.18 Astrobiology: Exobiology and Evolutionary Biology</td>
<td>3/15/07</td>
<td>July</td>
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Recent Signed off Selections

- Planetary Geology & Geophysics - Normal Selection
  - Proposals due May 5, 2006
  - Peer Review Panel in July 30 - August 4, 2006
  - Decision Document signed March 6, 2007
  - 49 selected; 52 declined (49% selection rate)
  - Average grant size: $67K/year
  - Total Time (submission to selection): 305 Days

- Stardust Sample Analysis - New Rules
  - Proposals due January 19, 2007
  - Peer Review Panel in March 27-29, 2009
  - Decision Document signed April 23, 2007
  - 22 selected; 0 selectable; 8 declined (73% selection rate)
  - Average grant size: $107K/year
  - Total time (Submission to Selection): 91 Days!

Grant Processing Status

- Check the NASA Shared Services Center (NSSC) website for grant status

http://www.nssc.nasa.gov/grantstatus

Overview of R&A Awards

- Success rate – Awarded / Total number of proposals
- FY07 Provides partial restoration of the 15% cut (~$5.8M)
Top Priority R&A Programs for Additional Funding

• Astrobiology: Exobiology & Evol. Biology
• Astrobiology Science & Technical Inst. Dev.
• Mars Data Analysis
• Mars Fundamental Research
• Outer Planets Research
• Planetary Instrument Definition & Development
• Planetary Protection Research

• Augmentation rules:
  - Astrobiology will have special consideration
  - Intent will be to fund all “Excellent Proposals”

Lunar Advanced Science and Exploration Research (LASER)

• LASER R&A will appear in ROSES 2007 and supports:
  a) Basic Lunar Science
  b) Exploration Lunar Science (Applied)
  c) Lunar Data Analysis of data within PDS
  d) Lunar Data Restoration - data than needs to go into PDS
  e) Ground-based observational support of LCROSS impact

✓ No selection quotas for (a)-(e)
✓ Proposals that span the Basic(a)-Exploration(b) science continuum encouraged

• Funding ~ $2-3M/year (Co-Funded: PSD-ESMD)

• Seeking 1, 2, or 3 year proposals

• LRO Participating Scientist will be a separate call in 2007

PSD R&A Program for ROSES 2007

• Astrobiology: Exobiology And Evolutionary Biology (pending)
• Astrominology Science & Technology Instrument Development & Mission Concept (pending)
• Astrobiology Science And Technology For Exploring Planets
• Cassini Data Analysis
• Cosmochemistry
• Discovery Data Analysis
• Early Career Fellowships
• In-Space Propulsion (pending)
• Lunar Advanced Science and Exploration Research *
• Near Earth Object Observations
• New Horizons at Jupiter Data Analysis *
• Orions of the Solar System
• Outer Planets Research
• Participating Scientist Program * [Not posted yet]
• Planetary Astronomy
• Planetary Atmospheres
• Planetary Geology And Geophysics
• Planetary Instrument Definition And Development
• Planetary Major Equipment
• Planetary Protection Research
• Mars Data Analysis
• Mars Fundamental Research
• Mars Instrument Development
• Mars Technology Project (pending)
• Sample Return Laboratory Instruments & Data Analysis

* New PSD R&A elements
Technology Investments

- Flight mission technologies
  - Radioisotope Power Systems
  - In-Space Propulsion Program
- Mars Technology Program
  - Mission specific technologies for strategic mission
  - Base technology – broad based technology effort to support future Scout and post-MSL missions
- Instrument Technologies from ROSES
  - Planetary Instrument Development & Definition Program (PIDDIP)
  - Astrobiology Science & Tech. for Exploring Planets (ASTEP)
  - Astrobiology Science & Tech. Instrument Development (ASTID)
  - Mars Instrument Development Program (MIDP)

In-Space Propulsion Development

- Solar Electric Propulsion -
  Reduced planetary trip times, wider launch windows, lower propulsion/payload mass ratios
  - NSTAR to fly on DAWN 2007
  - NEXT (3x increase in power over NSTAR), Hi/WHAC prototype thruster demos completed; NEXT system life testing in 2007
- Aerocapture - Shorter trip times to outer planets with less propellant, autonomous aerodynamic control technology also enables precision landing.
  - Mission design studies of Mars, Titan, Venus, and Neptune completed
  - Research on materials and sensors on-going, HEAT sensor used on MSL

RPS Near-Term System Development

- Three systems
  - Multi-Mission Radioisotope Electric Generator (MMRTG) – selected for MSL, 2009 launch
  - Advanced Stirling Radioisotope Generator (ASRTG) - final engineering design, > 30% efficiency, 7 watts/kg – demo 2009
  - Advanced RTG (space vacuum only, early next decade, 8%-10% efficiency, 7 watts/kg, thermocouple preliminary designs selected – demo 2010
- High efficiency and specific power systems for near-term missions
  - Ability to operate in deep space as well as in planetary atmospheres
  - Will meet needs of near-term missions ~ 2013-2020
  - (MSL, Flagship, NF3)

Planetary Science

Advance scientific knowledge of the origin and history of the solar system, the potential for life elsewhere, and the hazards and resources present as humans explore space.